DUPLICATE GENES

SOME interesting questions are raised by a recent article by Gregory: "On the Genetics of Tetraploid Plants in *Primula sinensis*."[1] Reciprocal crosses of two races of *P. sinensis* were made. One cross gave entirely normal results in F_2 as regards chromosome number and hereditary characters. The reciprocal cross gave an F_1 generation which was sterile with the parents and produced only a giant variety in F_2. This proved to have the tetraploid chromosome number. Experiments indicated that the genetic factors had also all been doubled, a very significant parallelism.

Gregory uses the nomenclature AAAA, AAAa, AAaa, Aaaa, and aaaa to represent all the possible conditions as regards a pair of Mendelian factors. He states that heterozygotes of the form AAAa should give gametes AA and Aa, and should produce, on selfing, the zygotes AAAA, 2AAAa and AAaa, and that the last class selfed should produce recessives. On the chromosome theory of heredity, this assumes that the four chromosomes concerned are equally likely to pair in synapsis in any of the possible ways, a very interesting phenomenon if the assumption proves correct. But it is conceivable that two independent synaptic pairs may be formed. It may be that only chromosomes from the same original race pair in synapsis. It is true that the first of the original crosses shows that the chromosomes of the two races can enter into normal mitosis and presumably into synapsis with each other. But the reciprocal cross indicates, perhaps, that in the environment of the cytoplasm of this cross, they can not enter into synapsis. If this condition continues in later generations, we should represent the zygotes as AAA′A′, AAA′a′, AaA′a′, etc. This is the way in which duplicate genes have been represented previously as by Nilsson-Ehle, East and Shull. With this representation, heterozygotes of the form AAA′a′ could never give rise to recessives after selfing for any number of generations.

Which hypothesis is true in this case could easily be determined by experiment. The published results are not sufficiently explicit on this point. If the original cross were of the type AA × a′a′, producing in F_1 Aa′, the F_2, AAa′a′, would be a homozygote on the second hypothesis, and recessives should never

[1] *Proc. Roy. Soc.*, B 87, 1914.

appear. On Gregory's hypothesis recessives should appear in later generations. On the second hypothesis, homozygous races of the types AAa'a' and aaA'A' would be obtainable, in appearance like heterozygotes. These would breed true indefinitely when selfed, but should give recessives in F_2 after crossing, as in a case proved by Nilsson-Ehle.

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NOTES AND LITERATURE

A STUDY OF DESERT VEGETATION[1]

Between three and four years ago Dr. W. A. Cannon, of the Desert Botanical Laboratory at Tucson, Arizona, visited southern Algeria in order to become acquainted with the more obvious features of the plant physiological conditions of the desert, and to make detailed studies of the root habits of certain desert plants. From Algiers the journey proceeded nearly due south about three hundred miles to Ghardaia, thence east about one hundred miles to Ouargla, and another hundred miles to Touggourt, returning through Biskra, and Batna to the northern coast. Throughout this long and wearisome journey the vegetation was studied in connection with the geographical and climatic environment and the results are brought together in a volume of somewhat more than eighty pages of text and thirty-seven plates, one of which is an outline map of the region visited.

Dr. Cannon speaks of the similarity of the flora of Algeria to that of southern Spain, France and Italy, where one is reminded of the vegetation of portions of California. Once in the desert on the way south low-growing shrubs on the plain become characteristic, including species of *Tamarix, Zizyphus* and *Artemisia.* Where water is available for irrigation, oases occur with their luxuriant vegetation of date palms, apricots, figs, mulberries, peaches, pears, oranges, as well as artichokes, beans, carrots, melons, peas, potatoes, squashes, etc. Further south the plain

[1] Botanical Features of the Algerian Sahara. By William Austin Cannon, Washington, D. C. Published by the Carnegie Institution of Washington, 1913.